

SCIENCE

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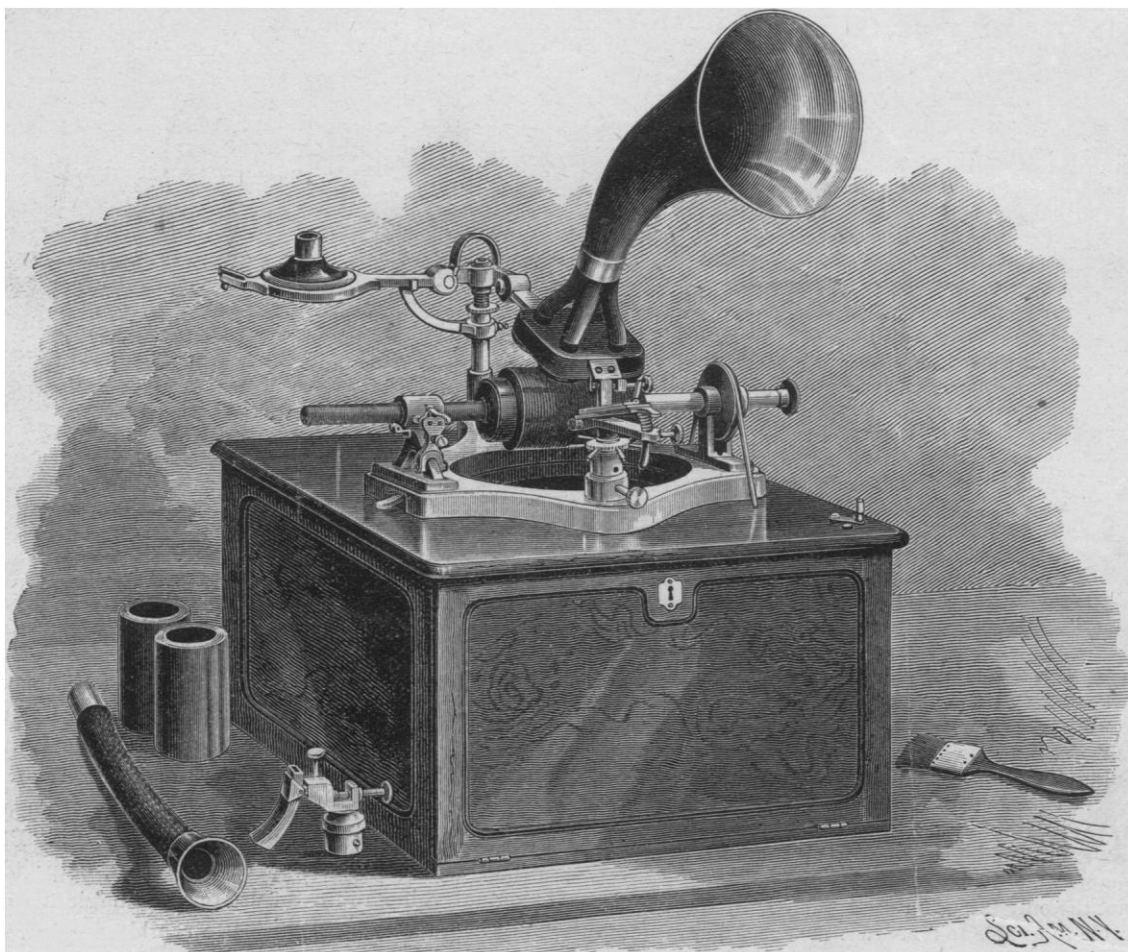
THE MICRO-GRAPHOPHONE.

IN the construction of my talking-machine, which I call the micro-graphophone, my object was to record articulate speech and other sounds, and reproduce them more distinctly, more naturally, and with greater volume, in order to obviate the necessity of hearing-tubes, and to be sure always of having a good record made and a good reproduction.

My experiments have shown me that to attain these ends there

points, called "nodes,"—points where the vibrations are indistinct or dead. If Tyndall and other scientists are correct (which I think will not be disputed), if a knife is attached to only one point on the diaphragm, the point selected may sometimes be dead or nearly dead, and consequently the vibrations existing in the plate cannot be correctly recorded. Such a diaphragm may sometimes make a very good record, and sometimes an altogether unsatisfactory one.

Suppose a spider attached to a vibratory body by many legs of



LIEUT. BETTINI'S MICRO-GRAPHOPHONE.

must be changes made as much in the recording device as in the reproducer. In my recorder, instead of attaching the recording knife to one point in the centre of the diaphragm, as in other talking-machines, I use a device which I call a spider, to which the knife is attached, and which has branches or legs of different lengths attached to several points of the diaphragm.

A diaphragm made to vibrate by sound-waves vibrates over its entire surface, but with different degrees of vibration at different points. Tyndall, and other masters of the science of sound, show how a vibrating diaphragm or body is covered with dead

different lengths, six or eight, or more (Figs. 2 and 3). Two or three of the points of attachment may be dead points, and unable to transmit vibrations; but by the others the knife will receive all that is necessary to make a good record.

The spider gives to my device other advantages. It gives more force to the knife in making a record, as this force is concentrated from several points, whereas in other machines it has but one source; further, it gives to the knife great steadiness, which I consider most important; and, further yet, a great advantage is that in my device not only are all the tones recorded, but also

the half-tones, the over-tones, and the intermediate tones. This I am able to demonstrate by mathematical figures.

To recapitulate. In recording articulate speech, or other sounds, I take the vibrations from the body or diaphragm at several points or places, and communicate them by independent conductors to a common point or place, causing the record to be made from this common point or place; and the record thus obtained is a perfect one.

In the reproducing device, instead of a small diaphragm made to vibrate by means of a needle attached in the centre by a point, I have a larger diaphragm (Figs. 1 and 6) divided into several smaller divisions,—three, four, five, or more,—and the vibrations are communicated to these different diaphragms by a spider, having in the centre, on one side, a reproducing needle, and, on the obverse side, legs extending to the centre of each of the smaller divisions.

Thus the method of reproducing articulate or other sound or sounds consists in causing a record of vibration to act at a single point or place, and from this point or place to communicate vibrations by independent conductors to the several diaphragms.

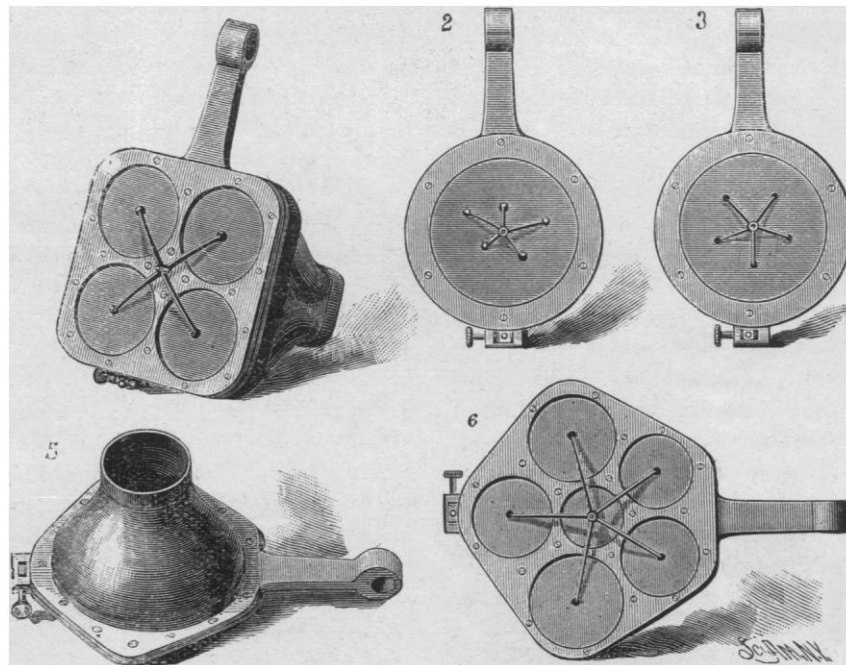
other sounds are always emitted into the room, still retaining all their natural qualities, and each completely distinct and distinguishable.

The micro-graphophone is shown in perspective in the accompanying illustration. In the base is an electro-motor, which, by means of the pulley shown at the right, drives the horizontal shaft carrying the recording cylinders. The illustration shows the reproducing diaphragm in position. The recording diaphragm is swung back, and is seen at the left of the figure. This recording diaphragm is operated by means of a flexible tube, which, with two of the recording cylinders, appear to the left of the base. The other device shown with these is the planing-tool for smoothing the cylinders preparatory to their use.

GIANNI BETTINI.

THE SOCIETY AND THE "FAD."

In a very recent issue of a young ladies' magazine (picturesquely called *Poet-Lore*) there lately met my eye the following sentence: "Browning and Ibsen are the only really



DIAPHRAGMS FOR BETTINI'S MICRO-GRAPHOPHONE.

It is very easily seen that a single diaphragm, which is made to vibrate in the centre by a needle attached to one point, will give a minimum result, because the diaphragm only vibrates, with appreciable result for our ears, in a small part of the centre.

A reproducing diaphragm, with a spider attached by its legs at several points, will vibrate over more of its surface; but the best method is to use a diaphragm with several smaller divisions. The result of several diaphragms vibrating at the same time will naturally give more amplitude to the reproduction.

But this is not the only important end attained by this device. It is very desirable to be able to reproduce the exact natural pitch or tone of the voice or other sound.

As with a number of tuning-forks, some of which will gather vibrations where others will not, one diaphragm, also, will take certain vibrations which others are unable to take on account of differences in tensions, dimensions, and other physical conditions.

In my device, having a diaphragm divided into several divisions of different tensions or dimensions, or varying in other physical conditions, I succeed in giving a more natural reproduction, both in volume and in pitch, because, in case unusual vibrations should be reproduced, I have always one or more diaphragms that will sympathize with these vibrations, and no vibration is lost.

With such devices, the micro-graphophone gives a reproduction for which no hearing-tubes are necessary. The voice and all

dramatic authors of their century." As things sometimes strongly suggest their opposites, this sentence reminded me of one of Professor Tyndall's splendid chapters, the one entitled "The Scientific Use of the Imagination;" which chapter quotes as its text the following passage from an address of Sir Benjamin Brodie to the Royal Society: "Physical investigation, more than any thing besides, helps to teach us the actual value and right use of the imagination,—of that wondrous faculty, which, left to ramble uncontrolled, leads us astray into a wilderness of perplexities and errors,—a land of mists and shadows,—but which, properly controlled by experience and reflection, becomes the noblest attribute of man, the source of poetic genius, the instrument of discovery in science, without the aid of which Newton would never have invented fluxions, nor Davy have decomposed the earths and alkalies, nor would Columbus have found another continent."

There is a use of the imagination which is of prophetic value: as, for example, the use which a poet like Goethe makes of it when he foresees, in his poetry, that which the

sciences shall in due time arrange for, and the arts accomplish. Goethe himself expresses this,—

“Thus in the roaring loom of Time I ply,
And weave for God the garment thou seest him by.”

There is also that nearer use of the imagination which is of immediate commercial importance, as when the promoter of a continental railway sees, in his mind's eye, a location through yawning cañons, and trackless forests on unbeaten mountain-sides, where his locomotives may clamber. And there is yet a third use of the imagination, which discerns enough importance in material and passing things, which to the general reader seem trivial and valueless, to lead the poet to preserve and chronicle them, and so perpetuate that which otherwise would disappear, and be lost forever to the student of humanity and of history. Poetry, then, in the latter case, has its practical as well as its sentimental uses, and it is not a matter of supererogation that organizations of individuals should meet to study and interpret the works of a poet as well as the works of a publicist or a philosopher. But when the poetry of a certain poet, however magnificent, is merely delineation of, or soliloquy concerning, that of which all the race is tenant in common along with the poet, it would seem as if the organization of a great society or a learned academy to penetrate that particular poetry or that particular poet was rather what we call a “fad,” or a *crochet*, than a work of any value to anybody. To illustrate the situation by use of an honored name (to which name I have no wish to allude other than with the highest respect): the death of Mr. Robert Browning has terminated what I think is one of the most wonderful—certainly the most unprecedented—phenomena in literature; namely, the spectacle of a poet writing poetry, and of the simultaneous organization on two continents of learned societies to comprehend that poetry as fast as it was written. Indeed, the remark of the witty person—that, just as great physical works are beyond the capacity of individuals, and so must be intrusted to corporations, so the comprehension of Mr. Browning's poetry, being beyond the single intellect, was committed to aggregations of intellect known as “Browning Societies”—appears to have been less a *bon mot*, and much nearer the truth, than had been generally supposed; for Dr. Furnivall tells us why he founded the original Browning Society. “The main motive for taking the step,” says the excellent doctor, “was some talk and writing of a certain cymbal-tinkler being a greater poet (that is, maker) than Browning. I couldn't stand that!” which rather appears to be only another way of saying that Browning was in danger of being neglected, simply because people could not readily ascertain whether there was any thing in him to study; and so that organizations must be formed, not to study something or other that was in him, but to find out if that something or other was there.

What I propose in this paper is an attempt to show, that, unlike the Browning Society, the Shakespeare Society is not an institution of this character, not organized to worship Shakespeare, or to study the Shakespearian method and form: but that it is an institution productive of real benefit, because its purpose is to study the matter (the material) in which Shakespeare deals; because we know that this matter is in him, without the organization of any preliminary pars-

ing societies—simply because, so unapproachably simple and coherent and scientific is his form, that we are able at a glance to ascertain whether he is worth studying or not.

Indeed, it would appear, from this very statement of the founder of Browning societies, that he himself perfectly well understood that a study of Browning merely meant a study of the particular Browning expression, fashion, method, form (or neglect of form, of which Browning himself boasts in his “The Inn Album”). And, if this were the excellent founder's meaning, we can well understand that he was right: for certainly, if Mr. Browning's own contemporary must quarry in Mr. Browning's poetry—must go at him with pick and spade just as a twenty-second century grammarian might do, he must not expect the yield he unearths to be any secret of his own century,—any thing not already his own property in common with Browning himself; any thing he did not know before, or could not have procured with less or equal labor elsewhere,—for certainly Mr. Browning had no sources of information, or access to sources of information, which his contemporaries did and do not enjoy or cannot procure. What the Browning Society occupies itself with, then, must be exactly that which, had Shakespeare societies been organized during Shakespeare's lifetime or immediately after his death, those societies would have been occupied with as to Shakespeare. The Shakespeare societies of 1600–16 would have found themselves in precisely the same position as to their poet as are our Browning societies to theirs. Their aim would have necessarily been, not to learn about their own century, about their own manners, their own customs, their own emotions, sensations, habits and speech, from the writings of one of themselves, but would have been limited simply to a study and interpretation of William Shakespeare's expression of his delineation of those customs, sensations, and emotions.

The Shakespeare Society of our day, as I understand it, has no such purpose as that outlined above. It is not founded and maintained in order to study, still less to worship, either Shakespeare the man, or Shakespeare the expressionist. Still less than either, I may remark in passing, is the Shakespeare Society organized to translate Shakespeare into the vernacular of the nineteenth century. As a matter of fact, Shakespeare's language is actually nearer our own than is that of any writer of any century preceding ours. Attempts to paraphrase usually end in obscuring him. There is not a sentence in the plays the drift and point of which—however an obsolete word, or archaic construction, or typographical error therein, may occasionally baffle us—is not perfectly intelligible. The Shakespeare Society is formed, rather, to study the age and customs in which and among which Shakespeare lived and wrote: the Shakespeare Society, in other words, is an antiquarian society, which has limited its researches to that the most interesting age of the English-speaking world,—the age in which those modern institutions which we prize most—art, manners, letters, society, jurisprudence, the common law which protects all these—were all springing to birth; of which institutions, it seems, William Shakespeare epitomized the very life, fibre, and being; leaving behind him not only a literature for the library and the student, but a record to which

the historian, the politician, the man of science himself, are eager to square themselves. And again: since the dramatic is the highest form of literature, and since Shakespeare made it so, the Shakespeare Society is also a dramatic society, and nothing which is dramatic should be alienated from it. At least, such was the belief of the first Shakespeare Society, founded in London by such gentlemen as the late honored James Orchard Halliwell (since Halliwell-Phillips), John Payne Collier, William Harness, Alexander Dyce, Douglas Jerrold, Bolton Corney, Charles Dickens, Peter Cunningham, Henry Hallam, and others. Harder-headed men than the above enumerated surely never came together; and if any one will take the trouble to look over the titles of the publications of this first Shakespeare Society, he will at least be conscientiously unable to jeer at *that* Shakespearian Society as a mutual admiration assembly. Those publications are entirely devoted to the preservation of such literary matter, records or chronicles, as throw, or threw then, a new light upon the Elizabethan and Jacobean ages, whose central figure William Shakespeare undoubtedly was. I do not know, had "æsthetic criticism" been then invented, whether or not the above-named gentlemen would have succumbed to its temptations; but I find it very hard to imagine that they would have so succumbed. I find it very hard to imagine Halliwell-Phillips and Charles Dickens and Henry Hallam lying "among the daisies, and discoursing in novel phrases of the complicated state of mind" of William Shakespeare. I am quite sure, indeed, that William Shakespeare himself would have been the very last to accept the "creative" or "æsthetic" (it is the same thing) criticism of the present period; which reads all sorts of sublime eschatological and moral moods, motives, and purposes into the few honest, direct, and laborious years which he passed in the busy London of Elizabeth and her successor,—passed there, at first in a struggle to earn his daily bread as a stranger in the crowded streets; then, later, to accumulate a fortune with which, like Horace's ideal gentleman, "far from the noise of trade" to retire to his boyhood's home, and "plough with oxen the fields of his ancestors." Blink the fact as we may:—insist on Shakespeare's moral purposes and immense visions of didactic services to his race as we may: still the fact remains that all the immortal plays were written in the course of this struggle, first for bread and then for wealth, and that William Shakespeare himself was, not only a poet and a dramatist, but a practical mounter of plays, and maintainer of theatres and theatrical companies, and lived and died so utterly unconscious that he had done any thing more than any other playwright, that he never made the slightest effort to perpetuate a line he had ever written, and took no notice in his will of any thing but his farms, his curtilages, and his cash. This is no place to give a list of the publications of that first Shakespeare Society; but I happen to recall one of them, a reproduction of the long-lost and forgotten cartoons which Inigo Jones drew in freehand to guide the designers and court carpenters in mounting certain masques for the entertainment of royalty, and this one publication may stand here for all the rest. Not in all those twenty or thirty volumes was there any posing of Shakespeare as a missionary, or dogmatic philosopher teaching moral, or æsthetic, or platonic, or any other sort of doctrines to his race. He

(Shakespeare) may be a great moral teacher to-day; but, had he been "a great moral teacher" in his own day, he would have played his companies to empty houses. In short, the purpose of the first Shakespeare Society was, what in my opinion the purpose of every Shakespeare club or society to-day should be: to illustrate rather than supply, and to preserve rather than to create. Here, then, is the point. Shakespeare was, however unwittingly, what we call "scientific" in the use of his imagination, not only because he wrote fully up to the despotic requirements of a stage and a scenic art which he could only imagine (since it was to be born centuries after his funeral), but because he selected for perpetuation, out of his own environment,—out of the riff-raff as well as the splendor, the lewd and vulgar as well as the lofty and the romantic,—that which was formative and genuine, and that of which—because it was formative and genuine, and not illusive and temporary—the centuries beyond him would be interested to study and inquire. Ben Jonson and his associate dramatists were on the ground just as Shakespeare was: they had precisely the access to their contemporary civilization that Shakespeare had; they preserved the fashions and the fads (what Aubrey called "the coxcombities") of their date just as well as Shakespeare did. But, since they were not vouchsafed what Sir Benjamin Brodie calls "the scientific imagination," as well as the romantic and dramatic imagination, they could not and did not know "which seed would grow, and which would not." The Elizabethan dramatists did not, as a rule, it seems, know to which "airy nothings" to give the "local habitation" and "name" which succeeding centuries should found academies and societies to investigate. Glorious as was the age they lived in, their eyes, as a rule, were sealed to the possibilities which were being born around him. Only to one among them was it given to body forth and turn to shapes the forms which should be valuable to posterity,—those actual, practical, and scientific forms which we throng our own theatres to-day to see with our own physical eyes, and which we organize our Shakespeare societies to study and to illustrate.

This, then, is the situation. Because Shakespeare held the mirror up to the nature which environed him, because he became the chronicler of those manners, societies, and civilizations of his Elizabethan day which were the germs of our own, it is worth while to organize societies to study him in every aspect and from every point of view. The Shelley society or the Browning society, on the other hand, has and will have only the form, the expression, the mood, of its poet to investigate and debate; for the material in which Shelley and Browning worked is not unique or personal either to Browning or to Shelley. Their preserve is just exactly the preserve of all other poets:—the Humanities, which are always to the fore, always the same, and always the quarry of contemporary poets. And the poet who appears to-day, or who shall appear to-morrow, will be more apt, I think, to write works which the centuries to come after him shall not willingly let die, if he looks for his society to be organized in those centuries rather than to-day or to-morrow; and this because it is only the centuries to come after him which shall be competent to decide whether his work was fit to live, or was only the thing of the moment,—“the tune of the time,” as Hamlet called Osric's flourishes.

Perhaps, in the flood of intellectual commentary and the analysis of Shakespeare's melody, eloquence, and literary style, attention has not been sufficiently attracted to this practical scientific form,—this "local habitation" which Shakespeare gave to his imagination,—how, with this scientific use of his imagination, he actually realized and provided for, not only the possibilities of the stage carpenter (an unknown functionary in his day), but that very modern opulence of modern stage architecture and effect which attracts us to our own theatres. Nobody can fail to be impressed, in witnessing modern Shakespearian revival, with the fact that the costliest and most prodigal of stage mounting which can be lavished upon a Shakespeare play on our metropolitan stage actually requires no amplification, or embellishment, or enlargement of the text, action or situations, to justify it; and that the stage directions of the acting editions of Shakespeare to-day are only those implied, if not expressed, in the text as Shakespeare himself left it. We have seen the splendors of Mr. Rignold's "Henry the Fifth," and of Mr. Booth's and Mr. Wilson Barrett's and Mr. Irving's "Hamlet," "Othello," and "Merchant of Venice," and of Mr. Daly's "Merry Wives of Windsor," "Taming of the Shrew," and "Midsummer Night's Dream;" but it should never be left unrealized that this dramatic author, who—three centuries ago—wrought out this dramatic material, never saw, except in imagination, and without the slightest rudimentary attempt at stage effect to guide his vision, all this machinery which his work to-day, and for our eyes, so imperatively demands.

The stage contrivances of Bottom's company—the man besmeared with loam to represent a wall, the man with a lantern and a dog to represent a moon—were scarcely burlesques upon the meanness and poverty, the petty economies and pitiable makeshifts, of the stage as Shakespeare himself knew it. I was most particularly impressed, in witnessing Mr. Daly's reproduction of "The Merry Wives of Windsor," with Mr. Daly's success in intimating this, without demeaning the effect of his own lavish stage machinery. Of course, the room in Ford's house in which Falstaff meets the ladies was, in the day to be represented, strewn with rushes (about a century was to elapse before interior luxury had even suggested sand). The ceilings were low and the timbers hewn, and the decorations mostly confined to an arrangement of the table utensils: trenchers, tankards, pots, and jugs. But to bring to his audiences the idea of the house of a thriving tradesman who had amassed "legions of angels," and so to tell the story of Falstaff's motives, Mr. Daly, of course, made the room a beautiful interior with carved furniture and wainscotings, and covered the floor with costly rugs. Shakespeare's own plays were not only mounted upon, but were immediately written for, a barren platform, where, if a couch was drawn in to signify a bed-chamber, or a table and two stools to signify an inn taproom, it was the force of a realism which could no further go. It was a company like the clown companies in "Love's Labour's Lost" or the "Midsummer Night's Dream," oftener than a company of Burbages or of Lowins, that spoke Shakespeare's mighty lines in the ear of Shakespeare himself; and his majestic and noble and tender women were, perforce, intrusted to beardless and callow boys, in days when for a woman to play a woman's part was an ineffable disgrace. The modern stage,

at the height of its opulence, is, then, but the imagination and the prophetic mind of Shakespeare; and Shakespeare was not only summit of the dramatic creator, but of the dramatic art as well. Like the projector of the continental railway, who sits in his saddle in the primeval forest and sees his vestibuled palace coaches, and hears his panting locomotives, Shakespeare stood upon his rude stage in the uncouth barn they called a play-house, and foresaw all that three centuries could amass of stage opulence and the lavishness of scenic art; and there and then he devised the situations, and moulded into poetry the dialogue which should describe and justify that opulence and that summit of dramatic art. There and then he bodied forth the form of things unknown—turned them to shapes, and gave to airy nothings a local habitation and a name. I do not say he knew what he saw, or knew that he was so writing for that which was to be his future. I do not know whether he did or not; but the result is here to-day.

Certainly this age, and the ages to come, may well organize into academies to study the mind and the workmanship of a man and a poetry like these.

Now, if Shakespeare has a rival; if there is another poet who builds and creates and preserves: and who—with a use of the imagination which we may thus properly call scientific—supplies not only his own generation and contemporaries, but generations yet to be born, with that which is useful (in that it can be acted) and beautiful (in that it can be admired) in poetry,—then let us organize an academy to that poet also; let societies be founded in his honor; and the less time we lose in the work, the better it will be for us. Have we such another poet? Is it Robert Browning? If there is any truth declared, or any discovery announced, in Mr. Browning's poetry, except the ordinary humanities with which all poetry deals,—the loveliness of virtue, the deadliness of vice, etc. (matters rather settled by this time, and as to which further testimony or didactic illustration is merely cumulative),—if there is, then by all means let us have Browning societies, and plenty of them. But if there is not; if it should appear that the great attractiveness of Robert Browning's poetry, the real reason why a taste for it has been sufficient to make it develop into a fad, and why the study of it associates worthy and excellent people into societies and clubs, has always been and is, simply that its meaning is not (like the meaning of Shakespeare's poetry, for example) apparent on its face: that it is not perfectly intelligible, that nouns are situated at long distances from their predicates, and that verbs, adverbs, pronouns, prepositions, and various other parts of speech, are understood from their absence or are to be guessed at from the tumultuous context; should it appear that, were Mr. Browning's poetry paraphrased into perfectly commonplace English, each noun and verb in its place, every substantive and predicate in their proper order, there would be no Browning societies;—then, I submit, it would seem as if Mr. Browning's poetry was and is, nothing but cumulative poetry. And the question arises whether your Browning societies are any thing more than societies for the working-out of conundrums, or puzzles, or rebuses; not, perhaps, adult parsing societies, but societies organized to ask what well-known sentiment could Mr. Browning have intended to express in these five words, what perfectly familiar proposition of mor-

als did he mean to restate by those six, etc. I do not by any means say that this is the case, or that Browning is not a great original poet for other reasons than a somewhat complicated syntax. I am only taking the liberty of using him, with the permission of his admirers, as an illustration; just as I have used Shakespeare as an illustration of a poet whose works have lived because (as I think) they are not purely didactic, or purely cumulative of examples of those principles and tendencies with which the world, since the date of its emergence from chaos, has been perfectly familiar.

Is it not a fact, that if, three hundred years from this date, a twenty-second century man should come across one of Mr. Harrigan's dramatic pieces (one of the "Mulligan" series, for example), he would find in it more chronicle of the familiar manners of the nineteenth century than he will find in Mr. Browning's poetry? Should the twenty-second century sociologist or philologist be interested in the city of New York, for example, will he not be more instructed by one of Mr. Harrigan's "Mulligan" plays than by reiterations, however antiquarian their sources, of those truths of human nature with which doubtless his own twenty-second century literature will teem? Men and women are pretty much alike in any century, have always been and doubtless always will be—the same passions, motives, and frailties. The comparative safety of virtue, and perilousness of vice; that goodness is rewarded and badness punished,—are items which doubtless the twenty-second century reader will concede as freely as we do. Nor will a narrative, however distinctly re-teaching those admirable lessons, become solely on that account immortal. The twenty-second century man will doubtless be fairly aware of the average moral probabilities. But, should he be a student of intellectual progress, or curious as to the Browning century, and desire to learn about this nineteenth-century poet's American cousins (to learn about as much of them as Shakespeare has dropped as to his own contemporary Dutchman and Frenchman and Spaniard); should he happen to direct his inquiries as to what were the manners, not of superior persons, but of the general, in the metropolis of the western nineteenth-century world; should he unearth its motley *mise en scene*, where Christian, Jew, and Pagan, where Occidental, Oriental, and African (white, yellow, and black), were all massed in good-natured communion,—he would find in one of Mr. Harrigan's pieces as rich a storehouse of folk-lore, and annotate it as eagerly and as learnedly as we annotate the "Comedy of Errors" or the "Merry Wives of Windsor." He would make notes upon the fact that such interesting ellipses as "Go chase yourself around the block," or "Take a drop, will you?" were an invitation to over-much pretension to descend from its stilts, with quite as much appetite, for example, as we to-day discover that such "sabre cuts of Saxon speech" as "painting the town red,"¹ or to "fire out,"² or "to shake,"³ or "It's a cold day"⁴ (meaning a day of disappointment), or "too thin,"⁵ are actually resurrections from the Shakespearian day and date.

[Continued on p. 288.]

¹ 1 Henry IV., II. iv. 13.

² Sonnet, cxliv. 14; Passionate Pilgrim, ii. 14.

³ Lear, I. i. 42.

⁴ Cymbeline, II. iii.; 2 Henry VI., I. i. 237.

⁵ Henry VIII., V. iii. 125.

NOTES AND NEWS.

THE Philopatrian Society of New York have waited upon Provost Pepper of the University of Pennsylvania with a view of establishing a chair in Gaelic at that institution. The question is under consideration.

—The Mexican Government has granted a concession to a company to construct a railroad from a point on the Inter-Oceanic Railway to the volcanoes of Popocatepetl and Ixtaccihuatl, and up the sides of those mountains.

—The United Electric Traction Company has been organized in this city, with a capital of seven million dollars. The new company is virtually a consolidation of all the various Daft electric companies into one central company. This will doubtless give a new impetus to the development of electric traction.

—The American Metrological Society, at a meeting held in Washington last month, advocated the adoption of the metric system by the government for custom-house and foreign mail service. The metric system is now used by twenty-four nations in invoicing goods for shipment abroad, and many of them use it for all purposes.

—The council of the Appalachian Mountain Club has issued invitations to a number of persons throughout the State of Massachusetts to a conference, to consider the subject of the preservation of natural scenery and historic sites in that State. The conference will be held at the Massachusetts Institute of Technology, on Saturday, May 24, at 12 noon.

—At the commencement of the Medical and Dental Departments of the University of Pennsylvania, held May 1, there were graduated 117 in medicine and 70 in dentistry. Of these, 3 were from Brazil, 2 from Cuba, 5 from Germany, 3 from Switzerland, 3 from Scotland, and one each from Hayti, Nicaragua, New Brunswick, Prince Edward Island, Nova Scotia, Japan, England, and United States of Colombia.

—Some interesting experiments on the physiology of sponges have been recently made by Dr. Lendenfeld of Innsbruck (*Humboldt*). He operated with eighteen different species, putting carmine, starch, or milk in the water of the aquarium, and also trying the effect of various poisons,—morphine, strychnine, etc. The following are some of his results, as we learn from *Nature*: absorption of food does not take place at the outer surface, but in the interior; only foreign substances used for building up the skeleton enter the sponge without passing into the canal-system. Grains of carmine and other matters often adhere to the flat cells of the canals, but true absorption only takes place in the ciliated cylindrical cells of the ciliated chamber. These get quite filled with carmine grains or milk spherules, but starch grains prove too large for them. Remaining in these cells a few days, the carmine cells are then ejected; while milk particles are partly digested, and then passed on to the migratory cells of the intermediate layer. Any carmine particles found in these latter cells have entered accidentally through external lesions. The sponge contracts its pores when poisons are put in the water, and the action is very like that of poisons on muscles of the higher animals. Especially remarkable is the cramp of sponges under strychnine, and the lethargy (to other stimuli) of sponges treated with cocaine. As these poisons, in the higher animals, act indirectly on the muscles through the nerves, it seems not without warrant to suppose that sponges also have nerve cells which cause muscular contraction.

—The four most valuable minerals found in Persia are coal, iron, copper, and lead, while it has been ascertained that there are large deposits of the purest petroleum in south-west Persia. In the north a coal-field of great extent has been proved to exist in the neighborhood of Teheran. The coal has been tested, and experts affirm that it will bear comparison not unfavorably with the best English coal. Another coal-field of excellent quality has more recently been discovered in the Gisakim Hills, less than fifty miles from Bushire. The total area covered by the coal-fields of Persia is believed to be vast. Nor are the iron mines less promising than coal. Those in the vicinity of Teheran, according to *Bradstreet's*, are very rich, the ore containing about 70 per cent of metal; and they are situate within half a mile of the coal field.

Iron does not seem confined to the one spot, iron and coal occurring in juxtaposition throughout the hills skirting the road from the capital to Kazvin, or even farther west. Much of the Persian iron is noted as containing hardly any sulphur and no phosphorus.

—One of the important objects of the American Museum of Natural History is the collecting and preserving a library of books and pamphlets; and to this object its trustees make an earnest appeal to its friends for their co-operation. Two very valuable libraries have been presented to the museum, — one on conchology, by Miss C. L. Wolfe; and the other on ichthyology, by Robert L. Stuart. The paper-mills of our country are annually grinding up tons and tons of old and new books of value to scientific institutions, and in some cases making it almost impossible to obtain them for the completion of sets. It is therefore desirable at once, so far as practicable, to secure copies of every thing which has been printed on natural history; for in this age of scientific research there is nothing which may not at some time be useful.

—The University of Pennsylvania authorities have at last taken a hand in college athletics, and hereafter the students will be more restricted in the various sports. The following rules, drawn up by a committee consisting of several of the faculty and representative undergraduates, will in the future govern all college contests: No student whose general average in the mid-term or term report is below "medium" shall be permitted to engage in any university athletic contests or match rowing-races, or play in any match games of base-ball, foot-ball, cricket, tennis, lacrosse, etc.; no student shall train for or enter any university athletic contest or rowing-race, or play in any match game of base ball, foot-ball, cricket, tennis, lacrosse, etc., without the consent in writing of Dr. Leuf; the university athletic contests and match rowing-races shall be held only on Saturdays or holidays; match games of base-ball, foot-ball, cricket, tennis, lacrosse, etc., may be played on the university grounds, on days other than Saturdays or holidays; after 3 P.M.; no team, or crew, or representative of the athletic clubs or associations, shall make more than one engagement each week to play outside of Philadelphia, excluding Saturdays and holidays.

—At a recent meeting of the American Academy of Political and Social Science, held in Philadelphia, Professor E. J. James of the University of Pennsylvania read a novel and interesting paper. He said that for the last nine months a most interesting experiment in railroad management has been going on in Hungary. As a result, a new system of passenger tariffs was worked out and put into operation on the first of August, 1889. The method adopted was that commonly known as the zone-tariff system, in which the rates are fixed, not according to the number of miles travelled by the passenger, but according to the number of zones traversed or entered upon during the journey. Starting from a given centre, the railroads are divided into fourteen zones or stretches. The first zone includes all stations within 25 kilometres of the centre; the second, all more than 25 and less than 40, etc.; each zone after the first, up to the twelfth, being 15 kilometres long, or, as we should perhaps better say, wide. Tickets are sold by zones, being good for all stations within the zone. How radical a change this system implies for a large part of the traffic can be seen in the extreme cases; i.e., in those in which the reduction has been the greatest. The fare for all stations in the fourteenth zone, which includes all stations more than 225 kilometres from the capital, are 8, 5 80 and 4 gulden respectively for the three classes, corresponding to \$2 88, \$2 08, and \$1.44. If we had the same rate in this country, it would be possible to buy a railroad-ticket to Chicago from New York for \$2.92. The fare from New York to Philadelphia would be 29 cents. The simplification of the tariff is very great. Under the old system, the number of distinct tickets which had to be kept in every large office was nearly 700. It is now only 92. The railroad-tickets are now placed on sale like postage stamps at the post-offices, hotels, cigar-shops, and other convenient places. The public is greatly pleased at the discarding of the complicated machinery of ticket-selling as practised under the old system. The most interesting thing, however, in this experiment, is the way in which the passenger traffic has increased under the stimulus of the new

rates. The number of passengers during the last five months of 1887 was 2,389,400; during the same period of 1888 it was 2,381,200; while for the same period of 1889 — the first period under the new system — it was 5,584,600, an increase of over 133 per cent. The receipts from the traffic under the new system were over 18 per cent greater than under the old. In other words, passenger traffic will respond to lower rates, — a thing which some railroad managers have denied. It would be well for our own railroad managers, who complain that passenger traffic is not profitable, to look into the matter. The American people, reputed to be the most restless in the world, do not have nearly as many passengers per head of the population as England, and it is far exceeded in the number of passengers to mile of railway by half a dozen countries of Europe.

—A writer in the *North China Herald* of Shanghai says that the climate of Asia is becoming colder than it formerly was, and its tropical animals and plants are retreating southwards at a slow rate. This is true of China, and it is also the case in western Asia. The elephant in a wild state was hunted in the eighth century B.C. by Tiglath Pileser, the King of Assyria, near Carchemish, which lay near the Euphrates in Syria. Four or five centuries before this, Thothmes III., King of Egypt, hunted the same animal near Aleppo. In high antiquity the elephant and rhinoceros were known to the Chinese, they had names for them, and their tusks and horns were valued. South China has a very warm climate, which melts insensibly into that of Cochinchina; so that the animals of the Indo-Chinese peninsula would, if there were a secular cooling of climate, retreat gradually to the south. This is just what seems to have taken place. In the time of Confucius, elephants were in use for the army on the Yangtse River. A hundred and fifty years after this, Mencius speaks of the tiger, the Leopard, the rhinoceros, and the elephant as having been, in many parts of the empire, driven away from the neighborhood of the Chinese inhabitants by the founders of the Chou dynasty. Tigers and leopards are not yet by any means extinct in China. The elephant and rhinoceros are again spoken of in the first century of our era. If to these particulars regarding elephants be added the retreat from the rivers of South China of the ferocious alligators that formerly infested them, the change in the fauna of China certainly seems to show that the climate is much less favorable for tropical animals than it formerly was: in fact, it appears to have become dryer and colder. The water-buffalo still lives, and is an extremely useful domestic animal, all along the Yangtse and south of it, but is not seen north of the old Yellow River in the province of Kiangsu. The Chinese alligator is still found on the Yangtse, but so rare is its appearance that foreign residents in China knew nothing about it till it was described by M. Fauvel. The flora is also affected by the increasing coldness of the climate in China. The bamboo is still grown in Peking, with the aid of good shelter, moisture, and favorable soil; but it is not found naturally growing into forest in North China, as was its habit two thousand years ago. It grows now in that part of the empire as a sort of garden-plant only. It is in Szechuan province that the southern flora reaches farthest to the northward.

—An interesting little railway has just been opened for traffic in England, between Lynton and Lynmouth, which are separated from each other by a cliff nearly 500 feet high, and are only connected by a road so steep as to be almost impracticable for vehicles. The new line, according to *Engineering*, is 900 feet long, with a uniform gradient of 1 in 1½, which is the steepest incline in the world. In spite of its shortness, the construction of the road has involved considerable difficulties; deep cutting having to be made through solid rock, and several streams of water having to be regulated. The motive power is supplied by water which is brought by 4-inch pipes from West Lynn, a distance of a mile, to a reservoir near the top of the incline. Two cars connected by a wire rope are moved together, the one dragging the other up the line as it descends, the necessary excess of weight being obtained by filling a tank on the car at the top of the incline from the reservoir already mentioned. Safety appliances have been fitted to stop the cars in case of accident.

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Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

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CONTENTS:

THE MICRO-GRAPHOPHONE	Gorse or Furze Geo. W. Perry;
Gianni Bettini 281	George M. Dawson 291
THE SOCIETY AND THE "FAD"	BOOK-REVIEWS.
Appleton Morgan 282	Stanley's Emin Pasha Expedition 291
NOTES AND NEWS 286	Essays of an Americanist 292
LETTERS TO THE EDITOR.	Electrical Engineering 292
Kiowa County, Kan., Meteorites	A Natural Method of Physical
F. H. Snow 290	Training 293
Experiments with Cave-Air	AMONG THE PUBLISHERS 293
M. H. Crump 290	INDUSTRIAL NOTES.
Sunspots, Tornadoes, and Mag-	The Crocker-Wheeler Arc-Cur-
netic Storms James P. Hall . . . 291	rent Motor 294

THE SOCIETY AND THE "FAD."

[Concluded from p. 286.]

And this, possibly, may be where the line is to be drawn between the usefulness of a poet or a dramatist to his own generation and date, and his value as an embalmer of manners to generations and dates long beyond him. Indeed, the very first piece of Shakespearian criticism extant¹ (it was written by John Aubrey prior to the year 1680, and I cannot see that the criticism of these two hundred or so years since has practically done any thing more than indorse it) represents Shakespeare in London in his own day, doing just exactly what Mr. Harrigan in New York has done in his. Shakespeare, who wrote "Hamlet," did not scruple to take his auditors into the tavern, the inn-yard, the bagnio, the jail; into the bum-bailiff's and the watchman's court, just as Mr. Harrigan has escorted his audiences into the slums, the opium-joints, the bar-rooms, the ten-cent lodging-houses, to the polls, the picnics, the chowder-parties, and the cheap excursions of the self-respecting newsboy and boot-black. The ears of Mr. Harrigan's audiences are treated less coarse-

¹ "He did gather humours of men daily, his comedies will remain witt as long as the English language is spoken, for that he handles *mores hominum*. He took in the humour of the constable at Grendon-in-Bucks which is on the road from London to Stratford."

ly than were those of Shakespeare. The nineteenth-century theatre-goer takes its Shakespeare extremely Bowdlerized. Doubtless Shakespeare went to a great many places where he should not, and where, had a Shakespeare society for the transcendental illumination of his works kept at his heels, he perhaps could not or would not have gone. But it is precisely because he did go to all these places, good or bad, untrammelled, that his pages are of such peculiar value to ourselves: preserving so much that but for him had been misunderstood, but which he recognized as worth the embalming; not minimizing for the sake of ears polite, nor yet distorting into prominence for the prurient, but simply embalming—life-size, as it was, and where it belonged—in the great *comédie humaine* of those matchless dramas. From courtier to courtesan, from commander to camp-follower, the sovereign, the soldier, the statesman, the merchant, the peasant, the clown—how they all talked and walked, and lived and died, Shakespeare has told us. King Henry discusses state-craft with his great ministers; we turn the page, and Pistol and Doll Tear-sheet are hurling Billingsgate at each other, with Falstaff as a mocking peacemaker; two carriers with lanterns are shifting their packs in an inn-yard, and talking of poor Robin, the last hostler, who is dead; another page, and Lady Percy, in Warkworth Castle, is pleading with the noble Hotspur to dwell less upon wars and big events,

"Of sallies, and retires; of trenches, tents,
Of palisados, frontiers, parapets;
Of basilisks, of cannon, culverin;
Of prisoner's ransoms, and of soldiers slain,
And all the currents of a heady fight"—

and to give some thought to wife and home and family. And in every one of these thirty-seven dramas there is the same rush of movement, the same panorama of life, of color, and of action, untrammelled and uninterfered with by any slightest hint that the poet preferred or enjoyed any one movement, class, or color, or life, to any other,—a simple photograph—and a negative untouched! And still from out this panorama may biographies be written, and still histories and sociologies unfolded, simply because this negative has not been tampered with. Here, too, is a faithful transcript of the progress of the date of the procession in which Shakespeare was marching along with the rest; and it is worth our while to pause a moment for an example of it. Observe that in the first quarto of "Hamlet" (1603) we have a stage direction, "Enter King, Queen, Corambis, and other lords;" in the second (1604) this entry is directed to be accompanied with "trumpets and kettle drums;" but, in 1623, the words "Danish March" are added to this stage direction. Here is a steady progress in realism: the play being Danish, the march was to be Danish also. Again in 2 Henry VI., in its first quarto form ("The Contention," etc.), 1594, Suffolk says to his captor,—

"Hast thou not waited at my trencher,
When I have feasted with Queen Margaret?"

But in the folio some thirty years later, Suffolk says,—

"How often hast thou waited at my cup,
Fed from my trencher."

This is a step in table etiquette. It came to be only the servant, and not the nobleman, who used the trencher. The

procession marches past us,—the lewd, the unpleasant, the coarse: along with the noble, the stately, the refined. It is all in perspective, and the perspective of Shakespeare is the perspective of history.

And so: because these pages of Shakespeare are crowded with data for the student of civilization: are not a single phase (much less a phrase)—of literature—not puzzles or rebuses to find the meaning of which is beyond the single intellect, but for which societies and clubs and guessing-parties must be formed: therefore it is that a society for the illustration of Shakespeare, and of the field of research which his name implies, is not the fad or fashion of the moment. Its work is not to worry and debate and wrangle as to the meaning of this or that or the other, ellipsis: or as to what truth of human nature the poet intended to refer in this or that or the other, monologue, or cryptogram, or episode, or epigram: its work is simply to trace, from the cues they find in the plays of Shakespeare, the origin of things now familiar, of institutions now important, and of customs still fraught with significance. So long as there is a substance to work, let us have the society and the academy to work it. It matters not much if the student's exuberance overbear him, or his commentary burst into apotheosis: what it behooves him, rather, to beware of, is a confounding of the scientific uses of the imagination with that considerable over-use of the imagination which in time becomes the febrile, not the scientific vision. To see the Spanish fleet which is not yet in sight requires only faith. It will materialize with patience; but—for those who see insight and introspection and dramatic power in whatever is beneath their analysis, in whatever they cannot parse, or (and I am not now speaking of Mr. Browning) which offends the ear polite—not faith, but the faith-cure, is the proper specific. Cumulative poetry may have its uses, but it is hardly worth while to organize societies to discuss it.

I beg to repeat that I have only used Mr. Browning and his poetry as illustrations, in this paper. I am very far from wishing to be understood as implying that both are not great, or that I do not honor the memory of the one or admire the majestic qualities of the other. Still less do I propose attempting prophecy on my own account, by asserting that in three centuries, or one century, from this date, great societies and colleges will not be incorporated to sit at the feet of Robert Browning's poetry, and to write volumes of æsthetic criticism, and to fill libraries with controversial biographies of Mr. Browning.

Not to make too much of the pronouncement, then, in the young ladies' magazine picturesquely called *Poet-Lore*,¹ that "Browning and Ibsen are the only two really dramatic authors of this century," it is as good a text, perhaps, as any other upon which to protest, not against the fad poetic (which is an institution, that, with one excuse or another,—Browning, Tolstoi, or Ibsen,—is, like the poor, always with us), but against this cruel misuse of the word "dramatic," and this (perhaps I may call it) over "bumpitious" employment of the prophetic vision, which magnifies our own taste of the moment into a judgment as to the probable opinions of posterity.

Certainly Browning is a dramatic poet, if writing plays that cannot be acted constitutes one a dramatic poet. (The

answer to this is, of course, that Browning's dramas have been acted: an equivalent argument would prove that women are men, because, once in a while, certain women have acted like men.) And as to Ibsen: well, one swallow makes a summer—sometimes; and the Ibsen craze is some weeks old already. As to the almost forgotten Tolstoi: if what is called "realism" is dramatic, then Tolstoi, like a photograph, is dramatic. Certainly, in this view, a photograph is more dramatic than an oil painting. But one is perhaps to be allowed his taste in photographs? One might, for example, prefer a photograph of Ibsen's mother or of his lady-love to a photograph of a dog fight or a pig-sticking; though the latter, of course, everybody would pronounce much the more dramatic. The fad poetic, in itself, is perfectly innocuous: the only possible danger is, that young persons are often led by it into the belief that any thing which is unpleasant or repulsive, or which has the taste of forbidden fruit,—any thing, in short, with which literature as a rule does not deal largely, or as to which the less said the better,—is dramatic. It is because I believe in the Shakespeare Society, and because it is to be feared that the Shakespeare Society (as an Institution) may be thoughtlessly confounded, in the minds of some, with this fad poetic (as an Institution), that I have attempted to here briefly dwell upon a few points wherein they differ.

Let us repeat. There is much that is coarse in the panorama of Shakespeare: but it is there, in its place, and does not dwarf the rest; nor is it the coarseness, any more than (to speak mildly) any other single feature of his dramas, which has made Shakespeare immortal. What is dirty is not on that account dramatic; it certainly is not on that account scientific. We may all of us enjoy Brown, Jones, and Robinson; but, keenly as we may enjoy them, Brown, Jones, and Robinson are not, from the mere fact that we do enjoy them yet (I quote again from the young ladies' magazine), "the only really dramatic poets of the century." As to that, it would seem rather the province of the centuries which come after Brown, Jones, and Robinson, to judge.

I believe that the great verdict as to who are, and who are not, great,—great poets, great dramatists, great masters of any art,—whose mortal labors deserve and justify and satisfy the founding of great societies,—are always, always have been, and always will be, based upon some such proposition as has been considered here. I believe that any thing which survives its own century must have something of the practical (of the scientific if you will) about it—even if it be a work of the imagination pure and simple. I believe that the verdict of the centuries as to who are, and who are not, dramatic poets, will be always based on just such tests as the centuries so far have applied to William Shakespeare. Were the "shapes" to which his pen turned "things unknown" actual and practical? Have we seen them with our own physical eyes? We know that the pages of Shakespeare have stood these tests, and that they have proved Shakespeare's poetry to be an orderly, symmetrical, proportionate, and absolutely true, chronicle of his own age and vicinage: not lifted into the clouds beyond the realm of human nature's daily food; glorified by an imagination none the less superb because not hectic,—an imagination which "bodied forth" forms, not chimeras; and truths, not fantasies. And I believe that it is because Shakespeare is the poet of the true

¹ March, 1890.

and the living, rather than of the didactic and the transcendental, that he is perennial and immortal.

APPLETON MORGAN.

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The editor will be glad to publish any queries consonant with the character of the journal.

On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

Kiowa County, Kan., Meteorites.

A REMARKABLE fall of meteorites of unknown date in Kiowa County, Kan., has recently been brought to the knowledge of the scientific world. Many of the citizens of Greensburgh, the county seat, were aware of the existence of these strange irons, and commonly called them meteoric; but there seems to have been no suspicion of their true character and value. Indeed, until the 17th of March, 1890, a specimen weighing 101.5 pounds had ornamented the sidewalk in front of a real estate office in the above-named town for about three years. The farmers in the vicinity of the locality where the fall had occurred had put some of the specimens to various uses.

They were first observed by cowboys, long before that portion of Kansas was open to settlement, while it was still a portion of the unrestricted cattle-range of western Kansas. The specimen before referred to, with two others of somewhat smaller size, had been removed from its original location by a cowboy, and buried at the head of a gulch about a mile distant. The cowboy had intended to carry the irons to Green's stage station, about eight miles distant, but was unable to transport so heavy a weight upon his pony. This was in 1885. The town of Greensburgh was laid out in that year, before the close of which the cowboy was taken sick, and died. Before his death, however, he informed two or three citizens of Greensburgh of his burial of the three strange stones. These citizens, about a year later, searched for and found the meteorites, bringing them in to Greensburgh.

Professor F. W. Cragin of Washburn College was the first scientific man who visited the farm upon which these masses had fallen, this visit occurring on March 13. He secured from one of the farmers five meteorites, aggregating in weight over a thousand pounds, the heaviest specimen weighing 466 pounds.

Professor Robert Hay arrived on the spot March 14, but did not obtain any specimens. The writer reached the interesting locality on March 17, and obtained one of the Greensburgh specimens which had just been secured by the farmer. He made a second visit on the 22d, securing the two remaining Greensburgh specimens, thus obtaining all three of the masses which had been removed by the cowboy. He made a third visit March 29, securing two other specimens, which had been obtained by the farmer from his neighbors. The weights of these five specimens are respectively 101.32, 71.50, 54.96, 52.82, and 35.72 pounds. These weights have been accurately determined (except that of the 71.50-pound mass) by the United States standard scales in charge of the Department of Physics in the University of Kansas.

The writer retains the 54.96-pound specimen for the Museum of the University of Kansas, the four others being now in the possession of Mr. George F. Kunz of New York City, who has also secured four of the five specimens obtained by Professor Cragin.

The total number of masses included in this fall was at least twenty. Two of them are in the possession of Professor N. H. Winchell of the University of Minnesota, and several have disappeared from view, either having been mislaid or being still in private hands. The total weight of all the masses must have exceeded two thousand pounds. They fell within an oval area about one mile in length.

The most remarkable point connected with the history of these meteorites is the fact that for five years they should have been known to so many citizens of Kiowa County before the attention of scientific men was directed to them. The wife of the farmer upon whose premises most of them were found persistently main-

tained that they would prove to be of some pecuniary value. This idea was, however, ridiculed by her relatives and neighbors; but she persisted in retaining control of most of the masses found upon the land pre-empted by her husband, until now the proceeds of this "iron from heaven" have cleared the farm from a heavy mortgage, and placed the family in comfortable circumstances.

These masses, during the period preceding their discovery by Kansas scientists, were put to a great variety of ignoble uses. One 75-pound specimen was used to keep in place the cover of a rain-barrel or the door of a cellar; another, weighing 350 pounds, served to hold down the roof of a stable; another, weight 210 pounds, was employed to secure the roof of a dug-out; another had been used with other common rocks to help fill up a hole under a barb wire fence through which the hogs had made their escape from their feeding-ground. This was the 35.72-pound specimen obtained on the writer's last visit, and was secured only after a long and anxious search.

Some of these specimens were only partially buried in the ground; others were struck by the breaking plough at a depth of from three to four inches; others at the second ploughing, five or six inches deep; others yet, by the stirring plough at the third ploughing in a subsequent season.

The specimen retained by the university weighed 54.96 pounds, or 24.93 kilos. It is an irregular plum-shaped mass, much pitted, and covered with a burned and weathered crust. Its extreme length is about eleven inches, and its breadth is seven inches. This specimen, as well as the others mentioned above, so far as examined by the writer, belongs to that class of meteoric iron known as "pallasite." It is composed of nickeliferous iron, including many cavities throughout the entire interior. These cavities are filled with troilite and a yellowish, glassy mineral, which is probably olivine. Some of the latter is very dark and less transparent.

The specific gravity, determined by Mr. E. C. Franklin, our assistant in chemistry, and obtained by weighing the whole mass, is 4.76. Two hundred and ninety-three grams have been removed from the larger end of the specimen, and a polished surface of about fifteen square inches has been obtained, which shows very well the structure. The Wiedmanstaeten figures, rather coarse in outline, were developed readily upon the polished iron surface by the application of nitric acid. The portion removed from the specimen is being used for analysis by Professor E. H. S. Bailey and Mr. E. C. Franklin, and the results of the analysis will appear later.

F. H. SNOW.

Lawrence, Kan., May 1.

Experiments with Cave-Air.

GRAND AVENUE CAVE is situated in Edmondson County, Ky., four miles from Mammoth Cave, on the Mammoth Cave Railway, and belongs to the system of great caves which are found in this section of the subcarboniferous limestone formation. Its extent has not been determined as yet, though from three to five miles are opened, showing a magnificent series of the grandest avenues to be found on the globe. The main avenue is about two miles long, and will average 40 feet wide and 30 feet high. This being the highest cave in this section makes it the driest in the rainiest seasons. The floors are covered with dust; but the absolute dryness of the air is best shown by a small house that was built in the cave some eighteen years ago, the wood, nails, lock, and hinges of which are as sound and bright as when first put in. A self-registering thermometer placed in the cave last November has registered 50° ever since, that being the unvarying temperature. Investigations looking to the use of this cool, dry, and pure air have been in progress for the past six months. A shaft 5 inches in diameter and 225 feet deep was sunk into the cave at a distance of 1,500 feet from its mouth, over which a small experimental building was placed. By means of a small Sturtevant exhaust fan, the air from the cave was brought into the room, and the temperature was reduced from 72° to 59° in less than an hour, thereby showing very clearly that with a large shaft, by which the friction would be greatly reduced, any quantity of this air can be distributed through a large building, thus placing it within the power of the owners to absolutely control the climatic conditions

of the house both as to temperature and moisture. The amount of air is inexhaustible, the quantity in sight being sufficient to fill 40,000 rooms $16 \times 18 \times 10$ feet. The opinions of many prominent scientists have been obtained concerning the use of this air for sanitary purposes, a few of which are here given.

Major J. W. Powell, director of the United States Geological Survey, in speaking of the utilization of cave-air currents for regulating the temperature of buildings, says, "The phase of the problem in which you are specially interested is of so great practical importance as to demand not only a special but a general solution. It would afford me pleasure to either take up the general problem or assign it to some competent authority for investigation, were the data adequate; but there are not accessible in this office a sufficient number of records concerning air-movements at natural openings of caverns to render the investigation useful; and, moreover, a final solution could not be reached without consideration of just such data as you are to seek, — data which are not now available. In response to your request to make suggestions concerning methods to be pursued and results to be expected, I can say but little. Indeed, I hope that you will soon be in a position to convey information to me and to the world at large upon the subject."

Dr. Billings of the Surgeon-General's Office, Washington, D. C., after making several suggestions, says, "Hoping that these suggestions will be useful to you, and assuring you that if the experiments indicated are properly carried out they will give some very interesting and valuable information, I remain yours sincerely," etc.

Dr. Henry O. Marcy, Boston, Mass., after consulting Dr. H. I. Bowditch, says, "Such air must be of the highest value for respiratory use in diseased organs. Of course, sunshine is important, and this is the chief drawback to establishing the sanitarium within the cave. To drive it by means of a fan through a house would certainly seem of much value. An aseptic atmosphere is the gain from the long sea-voyage or living on mountains or in wooded districts. Here we ever have fluctuations in temperature, and other conditions, beside moisture. It has recently been considered as of practical importance to furnish air to a great city, as London, from high towers: why not, and much easier for many reasons, from caves? The air freed from bacteria is, as you are well aware, one of the secrets of success in modern surgery."

Burton, in his "Anatomy of Melancholy," under the head of "Air Rectified" (p. 306), says, "In some parts of Italy they have wind-mills to draw a cooling air out of hollow caves, and disperse the same through all the chambers of the palaces, to refresh them, as at Castoga, the house of Cæsareo Trento, a gentleman of Vicenza, and elsewhere."

The only modern instance with which I am acquainted is the hall of the Palace of the Trocadéro, in Paris. This building is erected over a portion of the old stone quarries. In the course of construction all the openings were closed, with a few exceptions. When it was found that a strong, cool current came from the underground chambers, all the openings save one were closed. This one was walled up to keep out the surface water, and shrubbery was planted around it. The chambers were carefully cleansed and dried, and the air is permitted to enter through this opening, which is never closed. The old quarries act as an immense cooling chamber. Mr. C. H. Blackall, in a letter, says, "At the rear of the stage, on the left, is a large room, the floor of which is only a little below that of the auditorium, and at its lowest point. In this room are the fans which draw the cool air from the quarries through a large opening in the floor, and force it either directly to the hall, as in summer-time, or first to a heating-chamber, where the air is warmed by passing over heated pipes. The fans, air-ducts, etc., are so placed that the fresh air may be introduced at the top of the hall, and foul air drawn out at the bottom, or *vice versa*. The air ascends, or rather is forced up, a large brick shaft behind the stage, and carried across to the centre opening of the dome through galvanized iron ducts about 5×8 feet.

The architect of the palace, after saying that nothing has been printed on the subject, writes thus: "I have the honor to inform you that the hall of the Trocadéro has a capacity of about 1,620,-

000 cubic feet; that ventilation, which furnishes 3,240,000 cubic feet per hour, is obtained by means of two engines, each of 15-horse power, operating two inhaling and two exhaling ventilators (one of each kind for each half of the hall). These ventilators are perfectly alike, they are about 8.4 feet in diameter, and consist of helices of a thickness of half an inch, with eight wings at an inclination of forty-five degrees. The engines are horizontal stationary ones, with two cylinders on the principle of restraint and condensation. Two boilers furnish the steam. Each of these has a heating surface of about 189 square feet, and a capacity of 54 cubic feet. They are gauged to a pressure of 10 pounds. The entire machinery has given excellent results. One may say it works too well, inasmuch as under full power there is a great excess of air. Usually only one-fourth of the total possible power is applied, and this is very amply sufficient."

Taking into consideration the unlimited supply of pure, cool, and, as far as investigations go, aseptic air, together with high altitude (nearly 900 feet above sea-level), its situation in the midst of a virgin forest of oak and hickory, with a sandy soil (resulting from the wear of the Chester sandstone) and splendid drainage—indeed, every thing seems to conspire to make this a favored spot for sanitary purposes.

M. H. CRUMP.

Frankfort, Ky., May 3.

Sunspots, Tornadoes, and Magnetic Storms.

IN my letter regarding sunspots and tornadoes, printed in *Science* on May 2, 1890, reference was made to magnetic storms observed at Toronto near the maximum stage of the last sunspot cycle. From that memorandum, by a clerical error, were omitted the words "September, 1883," after "November, 1883."

JAMES P. HALL.

Brooklyn, N. Y., May 3.

Gorse or Furze

EUROPEAN furze grows in one spot in the island of Nantucket, where it has maintained itself for fifty years. It was introduced by an Irishman, who was homesick because it did not grow about his cabin, as in the Old Country. I have never seen the plant growing, but have seen branches gathered from it. I believe it has not spread to any great extent. It may be interesting to some that the Scotch heath also is found in one spot in the island, where it has continued for a long time.

GEO. W. PERRY.

Rutland, Vt., May 5.

YOUR correspondent, Mr. J. R. McGinnis, may be interested to learn that the gorse or furze (*Ulex Europæus*) has for many years been fully naturalized in the southern part of Vancouver Island, where, along roadsides and in waste places in the vicinity of Victoria, it is very common. The broom (*Sarothamnus Scoparices*), is also abundant in similar situations in the same locality, and both plants appear to be as much at home as in their native soil.

GEORGE M. DAWSON.

Geological Survey of Canada, May 5.

BOOK-REVIEWS.

Stanley's Emin Pasha Expedition. By A. J. WAUTERS. Philadelphia, Lippincott. 12°. \$2.

IF any one besides the great explorer himself is able to describe the progress of Stanley's eventful journey, which led to the complete overthrow of European influence in Equatorial Africa and to the return of the indefatigable Emin Pasha, it is Mr. Wauters, who has closely watched the progress of the expedition from the beginning to the end, and, being closely connected with the Belgian enterprises on the Kongo, had access to all the material bearing on the expedition. The author begins his graphic descriptions with a history of the conquest of the Soudan and the revolt of the Mahdi, which was the immediate cause of the difficulties with which the governor of the Equatorial Province was beset. The first half of the book is taken up by descriptions of the state of affairs in the Soudan, Dr. Junker's important expeditions and his

return home, and the preparations for Stanley's expedition, as well as his reasons for selecting the Kongo route.

As the events treated here comprise a long space of time, and have been the subject of much lively discussion, the concise review given by Wauters will help to gain a clear understanding of the perilous position of the few Europeans who were still in the Equatorial Province, and the greatness of Stanley's undertaking to relieve Emin Pasha, who at that time was completely cut off from civilization, and was badly in need of provisions, clothes, and ammunition.

We follow the journey of the expedition up the Kongo, and the difficult march up the Aruvimi. The mutiny which broke out after Stanley's first arrival in the Equatorial Province is described in letters of Mr. Jephson to Stanley. It is needless to repeat here the difficulties Stanley had to contend with on his march back to Yambuga, — the death of Major Barttelot, Stanley's return to the Albert Nyanza, and his almost forcible rescue of Emin, who, it seems, together with Casati, hoped to be able to continue work in the Soudan. The reports of the retreat of the caravan along the south shore of the Victoria Nyanza to Zanzibar are still too fresh in all minds to need to be repeated here. The book is illustrated with numerous cuts, and accompanied by a good map of the region traversed, in which all the recent discoveries of Stanley, as well as of other travellers, have been made use of.

Essays of an Americanist. By Dr. D. G. BRINTON. Philadelphia, Porter & Coates. 8°.

The contents of the present book may best be characterized by the author's own words in his preface to the volume: "The articles which make up the volume have been collected from many scattered sources, to which I have from time to time contributed them, for the definite purpose of endeavoring to vindicate certain opinions about debated subjects concerning the ancient population of the American continent. In a number of points, as, for example, in the antiquity of man upon this continent, in the specific distinction of an American race, in the generic similarities of its

languages, in recognizing its mythology as often abstract and symbolic, in the phonetic character of some of its graphic methods, in believing that its tribes possessed considerable poetic feeling, in maintaining the absolute autochthony of their culture—in these and in many other points referred to in the following pages I am at variance with most modern anthropologists; and these essays are to show more fully and connectedly than could their separate publication what are my grounds for such opinions."

The collection of essays is divided into four groups: ethnologic and archæologic; mythology and folk-lore; graphic systems and literature; and linguistic. The collection of so much valuable, and, above all, suggestive material in one volume must be highly welcomed, as many of the papers found in this volume were heretofore difficult to obtain. The subjects that are discussed by the author are of so great a variety—and mostly on hotly debated ground—that some of them have been and will be sharply discussed. The references to criticisms of these essays which Dr. Brinton gives will increase the value of the collection to the student. The essays constituting the first part of the book are selected to sustain the theory of the development of the American race on American soil, and of the independent origin of its culture. In the second part Dr. Brinton stoutly defends the possibility of explaining mythologies by means of etymology, by investigating the origin of the name of mythical beings. The essays abound in acute suggestions and theories, and will be found as entertaining as instructive.

Electrical Engineering for Electric Light Artisans and Students.

By W. SLINGO and A. BROOKER. London and New York, Longmans, Green, & Co. 12°. \$3 50.

THOSE who have watched the growth of electrical literature during the past few years have doubtless noticed the increasing tendency towards what may be called specialization on the part of writers of electrical books. This tendency, of course, is natural. As the literature of a science increases in volume, the major part of it must of necessity be limited in its scope to cer-

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tain branches or divisions and subdivisions of that science. Some of the more recent electrical works, therefore, are devoted to dynamo-electric machines, for instance, or to secondary batteries, or to motors; while the electrical treatises of a few years ago, almost without exception, aimed to cover the whole field of the science as far as it was developed at that time. The volume before us is a good example of this tendency toward specialization, and an equally good example of the comprehensive method of treatment followed in the earlier works on electricity. It is devoted wholly to the subject of electric lighting, and it covers that field so thoroughly that it leaves little to be desired in the way of information by either artisans or students.

One of the authors, Mr. Slingo, is principal of the Telegraphists' School of Science, and director of the Electrical Engineering Section of the People's Palace, London; and the other, Mr. Brooker, is instructor in electrical engineering in both the institutions mentioned. Having felt the necessity, in the course of their labors, for a single work covering the whole field of electric lighting, and not finding such a treatise ready to hand, they set to work to fill the gap in electrical literature, and the volume before us is the result. The book, though specially designed to fill a pre-determined place in the course at the institutions named above, also embraces in its scope the requirements of those actually engaged in the electric-lighting industry, as well as those of persons who, with little or no electrical knowledge, have under their supervision various kinds of electrical machinery. It will therefore be of service to managers of mines and factories, naval officers, and to all engineers who may at any time be brought

into contact with an electric-lighting plant. The book is illustrated by upwards of three hundred engravings.

A Natural Method of Physical Training. By EDWIN CHECKLEY. Brooklyn, W. C. Bryant & Co. 16°. \$1.50.

THE method of training advocated and taught in this little volume appeals at once to the good sense of the reader. It requires no machinery or apparatus of any kind, except, of course, the bones and muscles of the person training; and it may be taken up and pursued at any time and in any place, either with or without an instructor. The aim is not to produce champion rowers or boxers or sprinters, nor even to develop good "all-round" athletes, but to do for the body what education does for the mind. The aim is to put the body into the best possible condition for doing the work it has to do, and to keep it in that condition. The author believes that there is more "straining" than "training" in some of the popular systems of physical training practised in and out of the college gymnasium, and his method departs radically from those systems in many respects. But we find nothing in it that physicians could take exception to in the case of any person physically sound. The book is fully illustrated, many of the engravings being made from instantaneous photographs of the author in the different positions assumed in the course of training.

THE *Atlantic Monthly* for June will contain an article by Charles Dudley Warner, entitled "The Novel and the Common School," a pedagogical essay on reading and reading-books.

I took Cold, I took Sick, I TOOK **SCOTT'S EMULSION**

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getting fat too, FOR Scott's
Emulsion of Pure Cod Liver Oil
and Hypophosphites of Lime and
Soda NOT ONLY CURED MY Incipient
Consumption BUT BUILT
ME UP, AND IS NOW PUTTING
FLESH ON MY BONES
AT THE RATE OF A POUND A DAY. I
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SUCH TESTIMONY IS NOTHING NEW.
SCOTT'S EMULSION IS DOING WONDERS
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INDUSTRIAL NOTES.

The Crocker-Wheeler Arc-Current Motor.

THE first electric motors placed on the market by the Crocker-Wheeler Company were intended to be operated by a current of constant potential and low tension,—what is usually termed “an incandescent-light current.” Those motors were described and illustrated in these columns several months ago. While there is a large and steadily widening field for those constant potential mo-

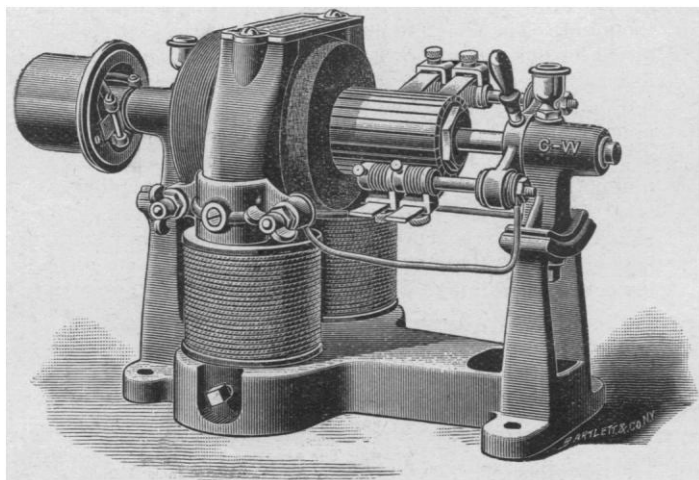


FIG. 1.

tors, and an increasing demand for them, there is also a field and a demand for motors wound for higher tension and constant current, to be operated on an arc-light circuit. To meet this demand the motor shown in Fig. 1 has been produced by the Crocker-Wheeler Company. The regulation of this motor is effected in the same way as in the same company's constant-potential motor; namely, by causing the armature to automatically move out of or into the field, thereby keeping the amount of torque or magnetic pull exactly proportionate to the work being done. The speed is thus kept constant, no matter what the variation in the

current or the load. The commutator and shaft bearings are made sufficiently long to admit of this longitudinal movement, which, besides its main function of varying the position of the armature with regard to the pole-pieces, also distributes the wear more uniformly on brushes, armature, and bearings.

Fig. 2 shows a novel application of a safety-cage or wire guard to a fan driven by a Crocker Wheeler motor. This guard is intended mainly to protect the fingers of children or meddlers from the effect of contact with the rapidly revolving fan, we suppose,

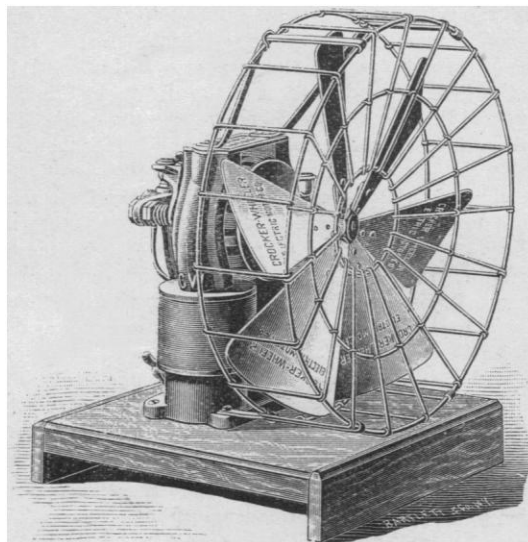


FIG. 2.

as we have observed that in cases of such contact the fan, like the equally deceptive buzz-saw, usually protects itself. An electric fan at full speed is cooling and comforting on a hot day, and very pleasing to the eye, but it will not bear handling.

As an effect of the extraordinary demand for electric motors produced by a better public appreciation of their merits, the Crocker-Wheeler Company have been compelled to remove from their former factory, which was by no means small, to a new location,—probably the largest establishment of its kind in the world.

CALENDAR OF SOCIETIES.

Biological Society, Washington.

May 3.—Robert Reyburn, The Life-History of Micro-organisms with its Relation to the Theory of Evolution; George Vasey, A New Grass Genus; W. H. Seaman, The Place of Biology in Public School Instruction; F. A. Lucas, The Present Status of Aurochs.

New York Academy of Anthropology.

May 6.—Edward C. Towne, The Physiological Causes and Evolutionary Conditions of Negro, Indian, and other Inferior-Race Peculiarities (a paper especially designed to present a scientific solution of the negro problem).

May 13.—Lucy M. Hall, The Disposal of the Dead.

Appalachian Mountain Club, Boston.

May 9.—W. F. Dusseault, The White Mountains of New Hampshire; Exhibition of a very fine collection of stereopticon views, prepared by members of the Boston Camera Club.

Boston Society of Natural History.

May 7, Election of Officers.—President, F. W. Putnam; vice-presidents, William H. Niles, B. Joy Jeffries; curator, Alpheus Hyatt; honorary secretary, J. C. White;

secretary, J. Walter Fewkes; treasurer, Charles W. Scudder; librarian, J. Walter Fewkes.

J. A. Jeffries, Lamarckism, with an Example; H. W. Haynes exhibited for G. Frederick Wright the palæolithic implement recently discovered by Mr. W. C. Mills in the valley of the Tuscarawas, Ohio.

CATARRH.

Catarrhal Deafness—Hay Fever.

A NEW HOME TREATMENT.

Sufferers are not generally aware that these diseases are contagious, or that they are due to the presence of living parasites in the lining membrane of the nose and eustachian tubes. Microscopic research, however, has proved this to be a fact, and the result of this discovery is that a simple remedy has been formulated whereby catarrh, catarrhal deafness and hay fever are permanently cured in from one to three simple applications made at home by the patient once in two weeks.

N.B.—This treatment is not a snuff or an ointment; both have been discarded by reputable physicians as injurious. A pamphlet explaining this new treatment is sent free on receipt of stamp to pay postage, by A. H. Dixon & Son, 337 and 339 West King Street, Toronto, Canada.—*Christian Advocate*.

Sufferers from Catarrhal troubles should carefully read the above.

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A large number of plants from Maine, Connecticut, Indiana and Illinois for exchange. Southern and western exchanges preferred. Address, enclosing lists, L. N. Johnson, 223 Chicago Ave., Evanston, Ill.

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Correspondence and exchanges solicited with persons interested in the study of American and Mexican antiquities. L. W. Gunckel, 36 Elm St., New Haven, Conn.

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